SOPA & QUALICIE Welcomes You On Presentation Quality Control in Soy Processing
Introduction

• This Presentation provides Basic Explanations for the Type of quality analysis needed at all stages of the soy supply chain in the industry.

• The objective is to Provide basic information about Quality Control and test that is applicable at operation Level.

• Quality Control Requirement and Applications of the methods and analyses will enhance the value of soy products through improved knowledge.
Quality Control

• The maintenance of a desired level of quality in a product, especially by means of attention to every stage of the process of delivery or production.

• A system of maintaining standards in manufactured products by testing a sample of the output against the specification.
Quality Control Requirements

• Specification / Standards
• Customer Requirement.
• Quality Plan Content .

Parameters, Specification, Method of Test, Frequency of Test, Sample Size, Acceptance Criteria, Conclusion
Steps For Quality Control

• Raw Material Inspection & Testing
• In process Stage wise Inspection and Testing
• Finished Products Inspection and Testing
• Applicable Physical, Chemical & Microbiological Parameters needs to be inspected or tested.
Soya Bean Production Process

1. Receiving
2. Cleaning
3. Drying
4. Tempering (optional)
5. Cracking
6. Expelling or Expansion (optional)
7. Flaking
8. Conditioning
9. Aspiration of hulls (optional)
10. Hulls
11. Soybean Oil
12. Solvent extraction
13. Desolventization / Toasting
14. Hexane
15. Drying / Cooling
16. Soybean meal
Soyabean Quality Control

• The quality of soya meal is the result of many factors, including bean variety, origin and storage.

• The various processing steps employed from the time the bean is received can affect the quality of the resulting meal and oil obtained.

• Heat treatment of the meal is essential to optimize its protein quality.

• The variables of moisture, temperature and time are interrelated and are important to achieve proper cooking conditions.

• The magnitude of these variables must be determined for each plant, and Quality Control plan needs to be prepared accordingly.
Basic Sampling Method of Soy Products

• The quality of any analysis carried out on feed or the feed ingredients stands or falls with the sampling tools and procedures.
• In order for any subsequent analytical work and interpretation to make sense, the collection of a correct, representative sample is fundamental.
• NOPA has published basic rules for the sampling of soybean meal at vessel loading facilities using an automatic sampling device.
• The tools that are used to sample depend on the material and form in which the ingredient has been transported.
• Automatic sampling of trucks or containers is increasingly implemented, hand-sampling remains a dominant means of obtaining sample of soy products.
Physical Inspection /Evaluation of Soy Products

• Three types of evaluations are carried out on soybean products. These are: Physical, Chemical and Microbiological.
• Physical examination of the material aims at establishing the general soundness of the product.
• Through Physical Examination Can Identified its origin and a rapid, general approximation of nutritive quality.
• A first appreciation of the degree of contamination with foreign material is obtained through visual inspection.
Chemical Analysis of Soy Products

- Moisture
- Ash
- Protein
- Amino Acid
- Crude Fiber
Chemical Analysis of Soy Products

• Lipid Quality
• Minerals
• Isoflavones
• Antinutritional Factors
• Mycotoxins
• Genetically Modified Organisms (GMO)
Chemical Analysis of Soy Products

- Neutral Detergent Fiber (NDF)
- Acid Detergent Fiber (ADF)
- Lignin
- Starch
- Non starch Polysaccharides (NSP) & Monosaccharides
- Ether Extracts
Moisture

- Moisture content is one of the simplest nutrients to determine, but at the same time is one of the most important. The moisture content of soybean products is important for three main reasons:
  - To establish the appropriate acquisition price based on the concentration of the nutrients.
  - To assure that mold growth cannot occur. Mold growth will result in a significant increase and Can Damage quality of Products.
  - A wrong determination of moisture will affect the rest of the nutrients when expressed on a Dry Matter Basis.
Ash

• Monitoring ash content is not only a way to assess the nutritional quality of soybean products

• also to detect possible contaminations, especially soil.

• the ash content of soybean meal should not exceed 7%.
Protein

• Protein is the most important and frequently analysed nutrient in soy products.
• The protein content of soybean products is estimated as total nitrogen in the sample multiplied by 6.25.
• Two methods for determining nitrogen in organic matter were developed: the Dumas method based on nitrogen combustion and the Kjeldahl method based on the reaction of sulfuric acid with organic matter to convert all nitrogen into ammonia.
Amino Acid

• Amino acid composition of proteins is essential to characterize their biological value. The greater the proportions of essential amino acids the greater the biological value of a protein.

• The amino acid analysis requires the use of high performance liquid chromatography (HPLC) or the combination of commercial kits and gas chromatography (GC).
Crude Fiber

• Intended to quantify the materials in the feed that form part of the cell wall.
• Provide relatively low energy as their digestibility is usually low.
• Technique was meant to quantify cellulose, certain hemicelluloses and lignin.
Chemical Analysis of Soy Products

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Neutral Detergent Fiber

• Neutral detergent fiber (NDF) accounts for the cellulose, hemicellulose and lignin content of soybean products.

• These fractions represent, most of the fiber or cell wall fractions of soybean products.
Acid Detergent Fiber

• It is recommended that ADF is determined sequentially, that is using the residue left from NDF determination.
• If not done sequentially, some fractions of pectines and hemicellulose could contaminate and overestimate the ADF fraction.
Lignin

• Lignin is a polymer of hydroxy alcohols.
• Lignin acts like a shield that prevents the action of enzymes and bacteria, by physical means.
• Determination of lignin is important to estimate the digestibility and energy value of certain, fiber-rich, soybean products.
Starch

• The starch content of soybean products can be determined with a large number of methods.

• Most common methods are the polarimetric method and the enzymatic.

• The polarimateric method, also referred to as the Ewers method.

• The most common alternative method of starch determination is the enzymatic method.
Non Starch Poly saccharides (NDF) & Mono saccharides

• A large part of the NFE fraction of soy products may belong to the group of non-starch polysaccharides.

• This group is composed of fairly simple, soluble and insoluble sugars, most notably raffinose, stachyose, and xylans.

• A major proportion of these sugars are not readily digested, especially by young animals and they are thus often considered part of the ANF.

• Correct estimation of these sugars or the mono-saccharides that make-up these NSP is important when formulating special diets.
Ether Extracts

• The ether extract (EE) method measures the proportion of a feed that is soluble in ether.

• It is equivalent to the total amount of lipids present in a feed and it represents mostly true fats and oils.

• However, it also includes some ether-soluble material that are not true fats, such as fat-soluble vitamins, carotenes, chlorophylls, sterols, phospholipids, waxes and cutins.
Minerals

- Lipid Quality
- Minerals
- Isoflavones
- Antinutritional Factors
- Mycotoxins
- Genetically Modified Organisms (GMO)
Lipid Quality

- Fat or oil quality depends on the fatty acid profile, specific physical characteristics and the oxidation level.
- While fatty acid characteristics and composition determine the physical and nutritional quality of the true lipid fraction.
- The physical characteristics and oxidation level are the aspects that are of greatest importance in the routine QC procedures that are applied when oils or fats enter the feed production process.
- Consequently, the two most common physical tests to assess quality of oils are the insoluble impurities and the unsaponifiable matter. Along with moisture in the oil or fat sample, these characteristics are collectively referred to as the MUI (Moisture, Unsaponifiables, Insolubles) value.
Minerals

• Mineral composition of soy products can vary considerably among and within products.
• The concentration of minerals depends greatly on a number of factors most notably the origin and crop-growing conditions of the soybean.
• The variety and the different types of extraction processes that are applied to obtain the soy product.
• Although a measure of the concentration of these minerals is important for most feed applications
Isoflavones

• In many diets, human as well as animals, soybean products are the main dietary source of isoflavones.
• These secondary metabolic compounds may play an important role in preventing cancers and reducing risk of cardiovascular diseases.
• There is also an increasing interest in the role and use of isoflavones in animal production as these compounds have been implicated in enhancing immunity and improving growth.
• Two forms of isoflavones can be determined: the bound glucoside form (genistin, daidzin, glycitin) and the free aglycone form (genistein, daidzein, glycinein)
Antinutritional Factors

- One of the most important restrictions on the use of soybeans and their products in animal diets is the presence of a relatively large number of antinutritional factors.
- The presence of these factors is also the main reason why different technological treatments are applied to soybeans or their products.
- The ANF in soybeans include compounds classified as protease inhibitors, phyto-hemaglutins (lectins), urease, lipoxygenases and antivitamin factors which can relatively easily be destroyed by heat application or fermentation.

- To analyse for any ANF a large number of different methods and procedures are available ranging from instrumental (HPLC, GC, CE) to thin-layer chromatography (TLC) and immuno-assays.
Mycotoxins

- Mycotoxins are a major quality concern for the feed industry.

- Soy products do not generally show the same level or range of mycotoxin contamination as cereal grains.

- Regulatory restrictions on mycotoxin levels are becoming increasingly more stringent.

- As in the case of ANFs, the analyses for mycotoxins and their metabolites can be carried out by a range of methods. For practical QC purposes, however, the use of the TLC and ELISA tests are recommended.
Genetically Modified Organisms

• Some soybeans have been genetically modified. As market demands for traceability are growing and market demands for non-GMO products are decreasing, it is important to be able to distinguish between genetically modified and traditional products.

• Certain official maximum limits on the presence of GMO material in non-GMO products exist.

• GMO varieties are characterized by the insertion of a new, functional gene (or cluster of genes) into their genomes. The expression of these genes provides the soybeans with some advantages, such as resistance to insects and herbicides.

• Several commonly used GMO testing protocols, including biological tests, as well as ELISA and PCR (polymerase chain reaction) tests,
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